

Soldering

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Objectives

- Definitions
- Soldering alloys
- Fluxes
- Torches
- Techniques

Definitions

- Soldering is the process of joining two or more metal parts together by means of a molten filler metal. The filler metal has a lower melting point than the adjoining metal.
- Soft soldering -- 400°F to 500°F
- Hard soldering -- 1100°F to 1300°F

Lead Soft Solder

- Lead-Tin Alloy
- 50/50
- 361°F - 421°F
- Solid wire
- 1/8" or 1/16" dia
- Excellent for brass copper
- Fair for steel
- Lead is toxic



Lead Free Soft Solder

- Tin-Silver Alloy
- 96/4 or 95/5
- 430°F
- Solid wire
- 1/8" or 1/16" dia
- Excellent for brass copper
- Fair for steel



Cadmium Hard Solder

- Silver Alloy
 - 45% silver
 - 15% copper
 - 16% zinc
 - 25% cadmium
- BAg-1
- 1120°F - 1162°F
- 1/16" or 1/32" dia
- Use for all boiler work
- Cadmium is toxic



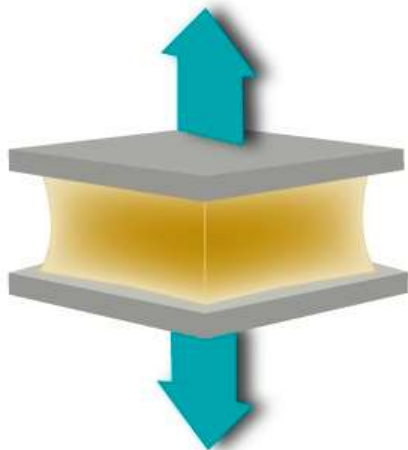
Cadmium Free Hard Solder

- Silver Alloy
 - 56% silver
 - 22% copper
 - 17% zinc
 - 5% tin
- BAg-7
- 1148°F - 1202°F
- 1/16" or 1/32" dia
- Use for all boiler work

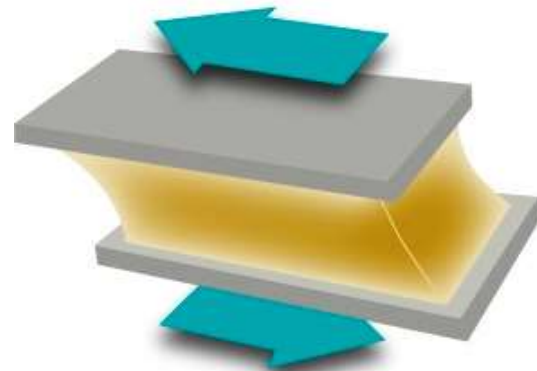


Strength of Solder

- Tensile Strength
 - Soft 4,500 PSI
 - Hard 32,000 PSI



- Shear Strength
 - Soft 2,900 PSI
 - Hard 17,500 PSI



Surface Preparation

- Close gaps - 0.003” preferred, up to 0.010”
- Remove all contamination, dirt, oil paint, oxidation.
- Mechanical - sanding, steel wool, wire brush
- Chemical - Use of flux
- Wetting or tinning

Soft Solder Flux

- Water Based

- Paste form
- 600°F Max temp
- Use with lead free solder
- Soap/water clean up



- Petroleum Based

- Paste form
- 600°F Max temp
- Use with leaded solder
- Solvent clean up



Hard Solder Flux

- Water Based
 - Powder-paste form
 - White or black
 - 1600°F Max temp
 - Chemically remove residue



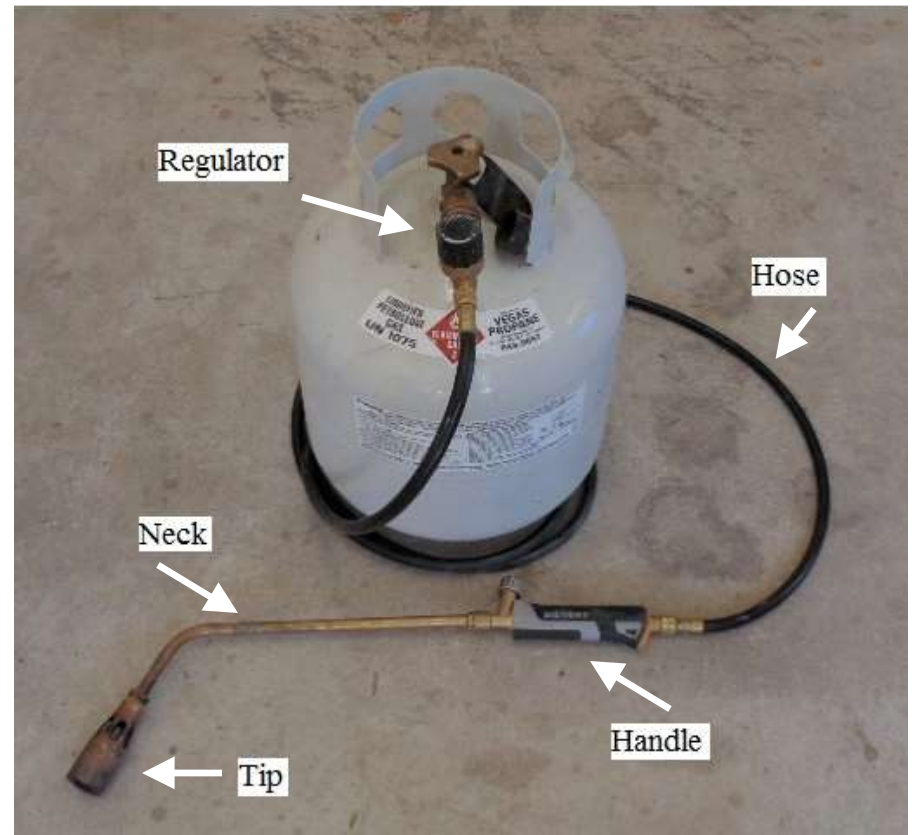
Torch for Soft Soldering

- Standard “Bernzomatic”
- Low temperature
- Low volume flame



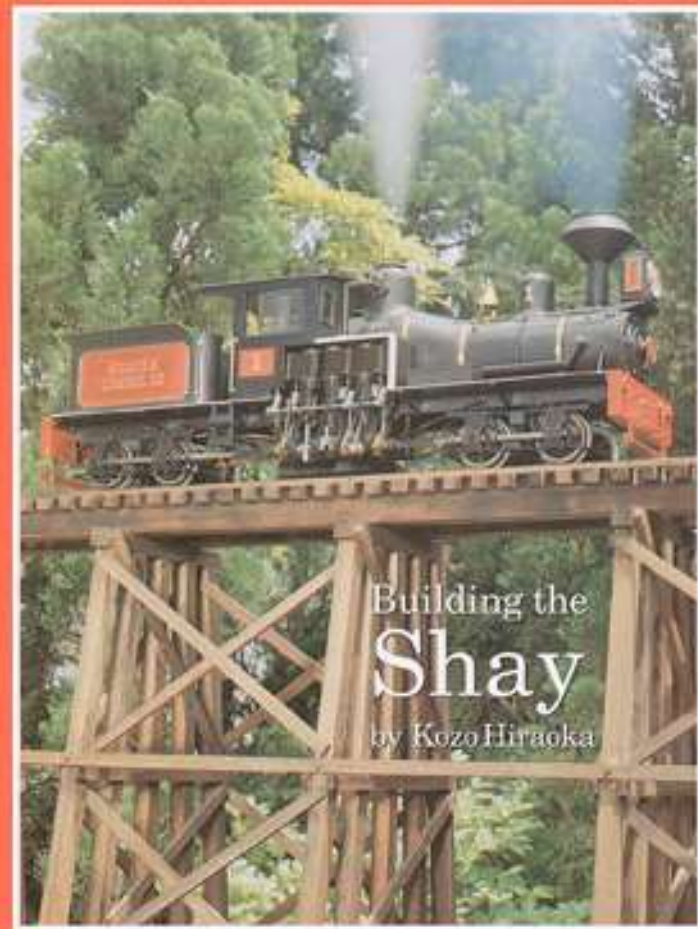
Torch for Hard Soldering

- Sievert propane-air or equivalent
- 5 gal propane tank
- Bestmaterials.com
- # 2942 tip -- 87,000 BTU
- # 2943 tip -- 148,000 BTU

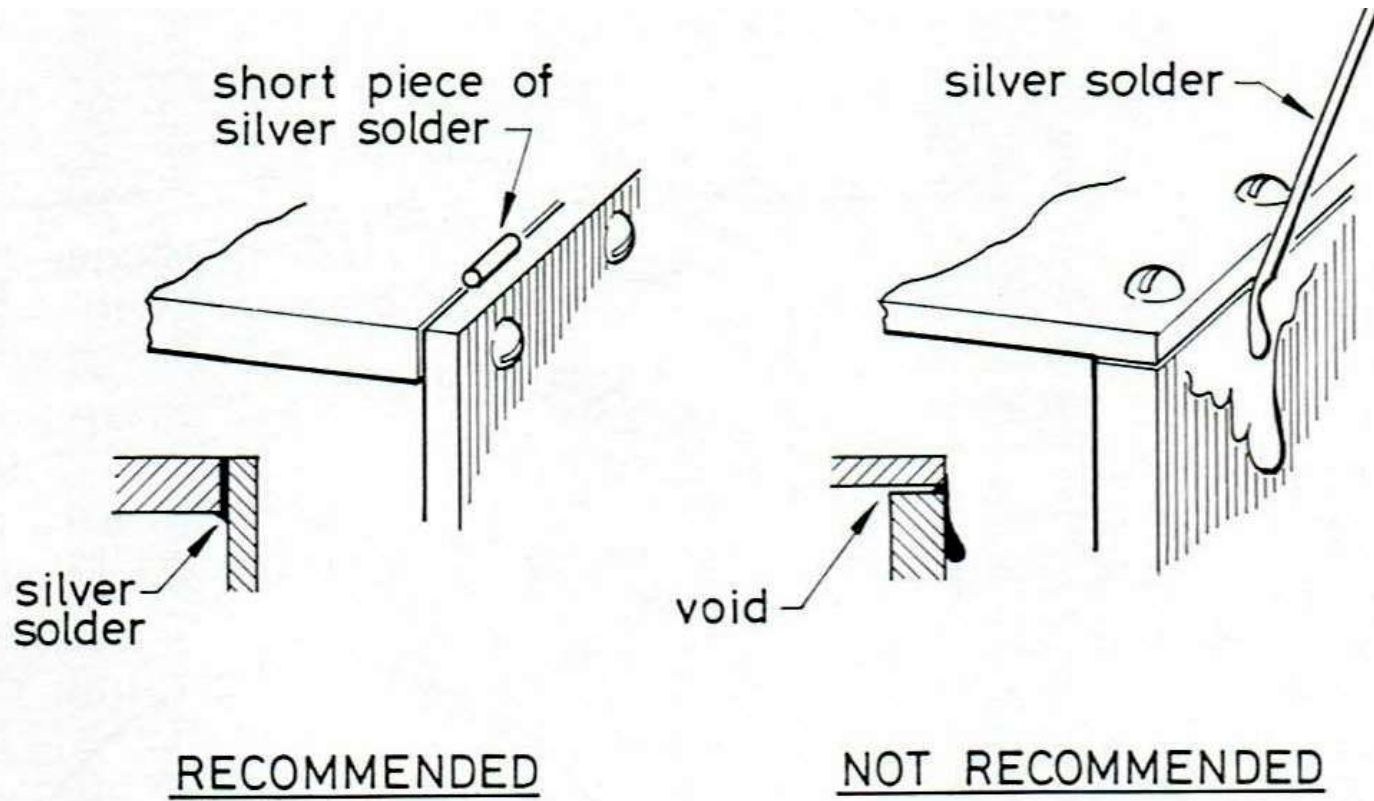


Soldering techniques

- “Building the Shay”
by Kozo Hiraoka
- Village Press
- ISBN 0-914104-07-1

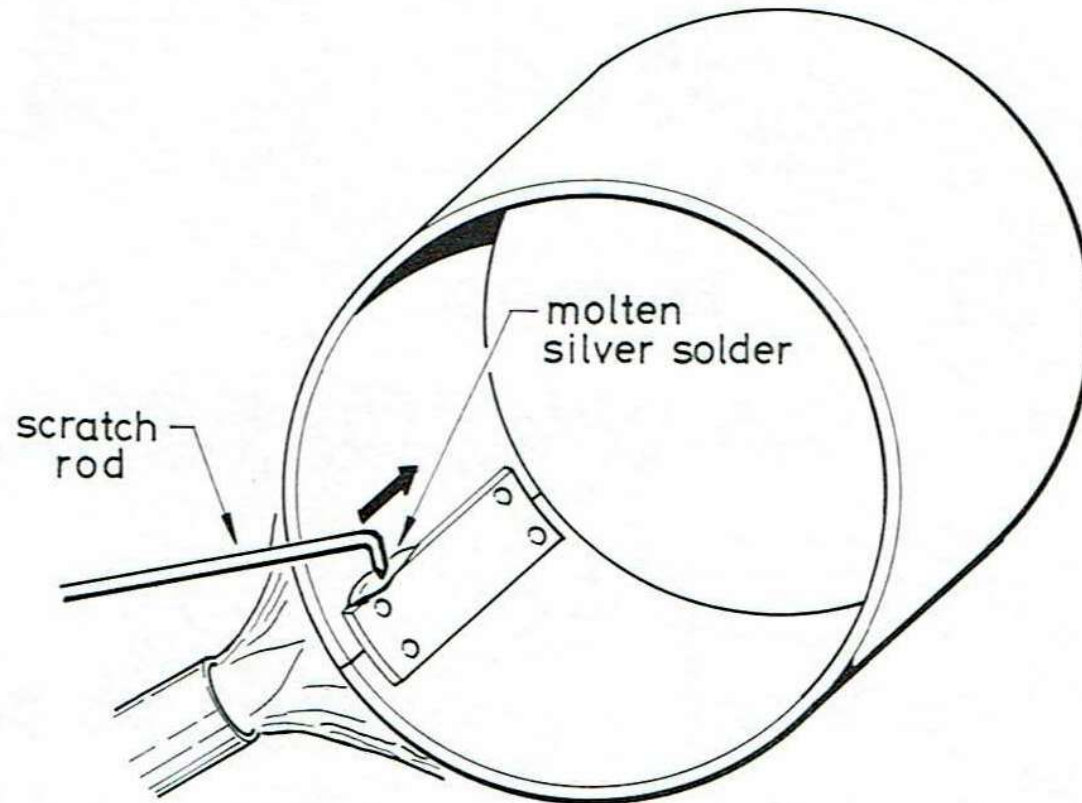


Use short pieces of solder

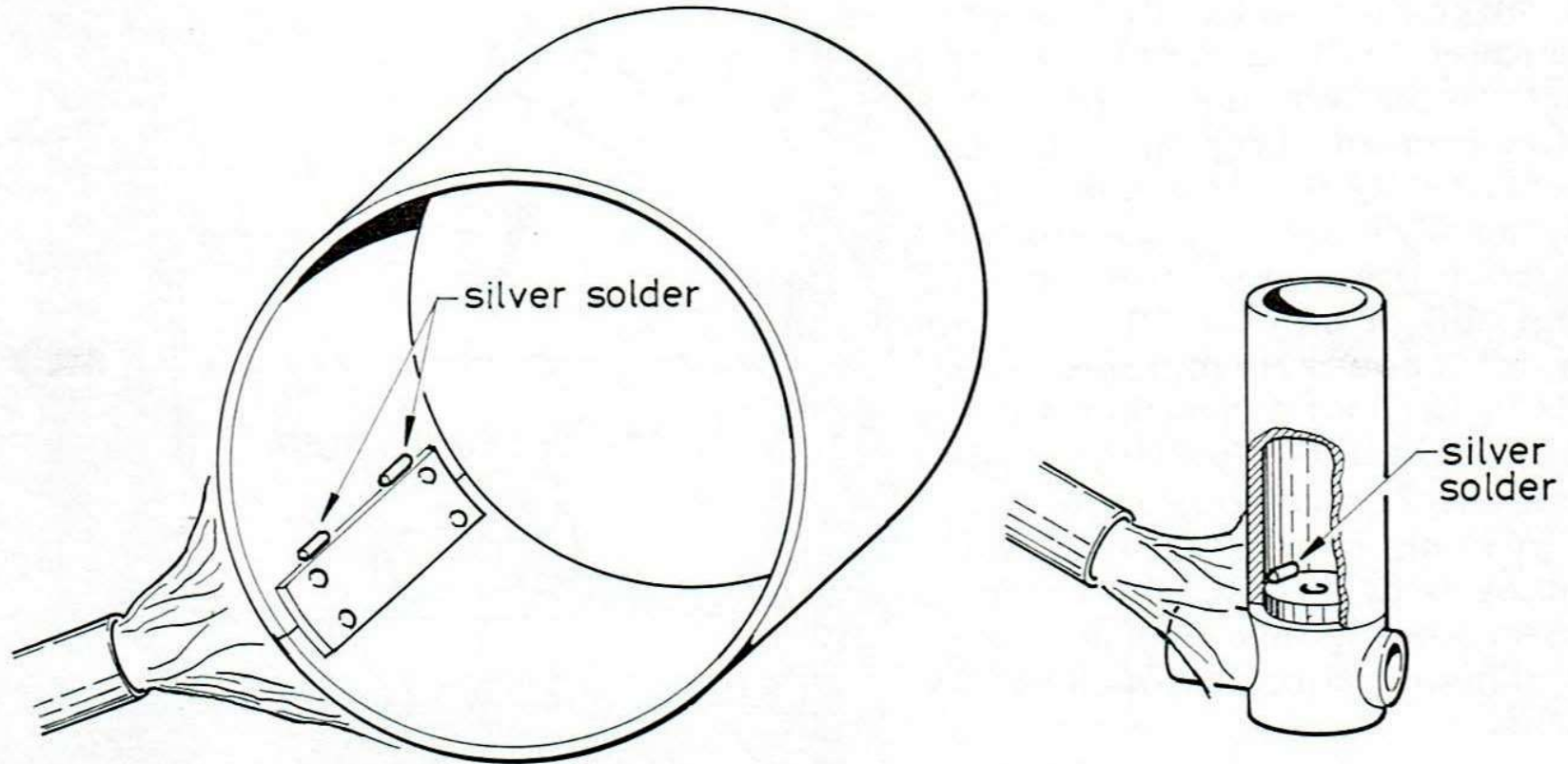


PLACE ASSEMBLY SO THAT GRAVITY
WILL ASSIST CAPILLARY ATTRACTION

Use a “scratch rod”

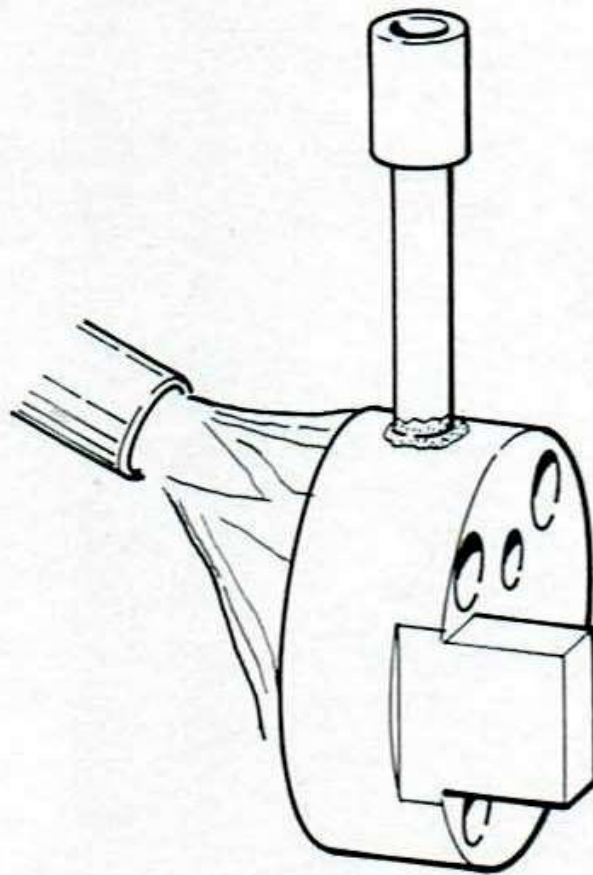


Apply heat from the back

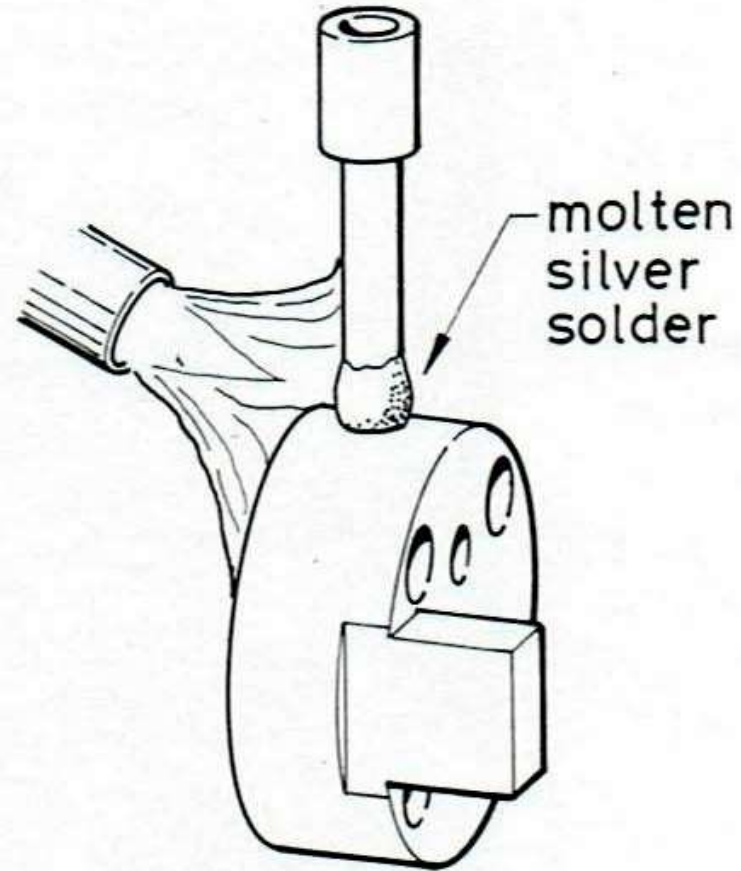


APPLY HEAT FROM BACK WHEREVER POSSIBLE

Apply heat to heavier part

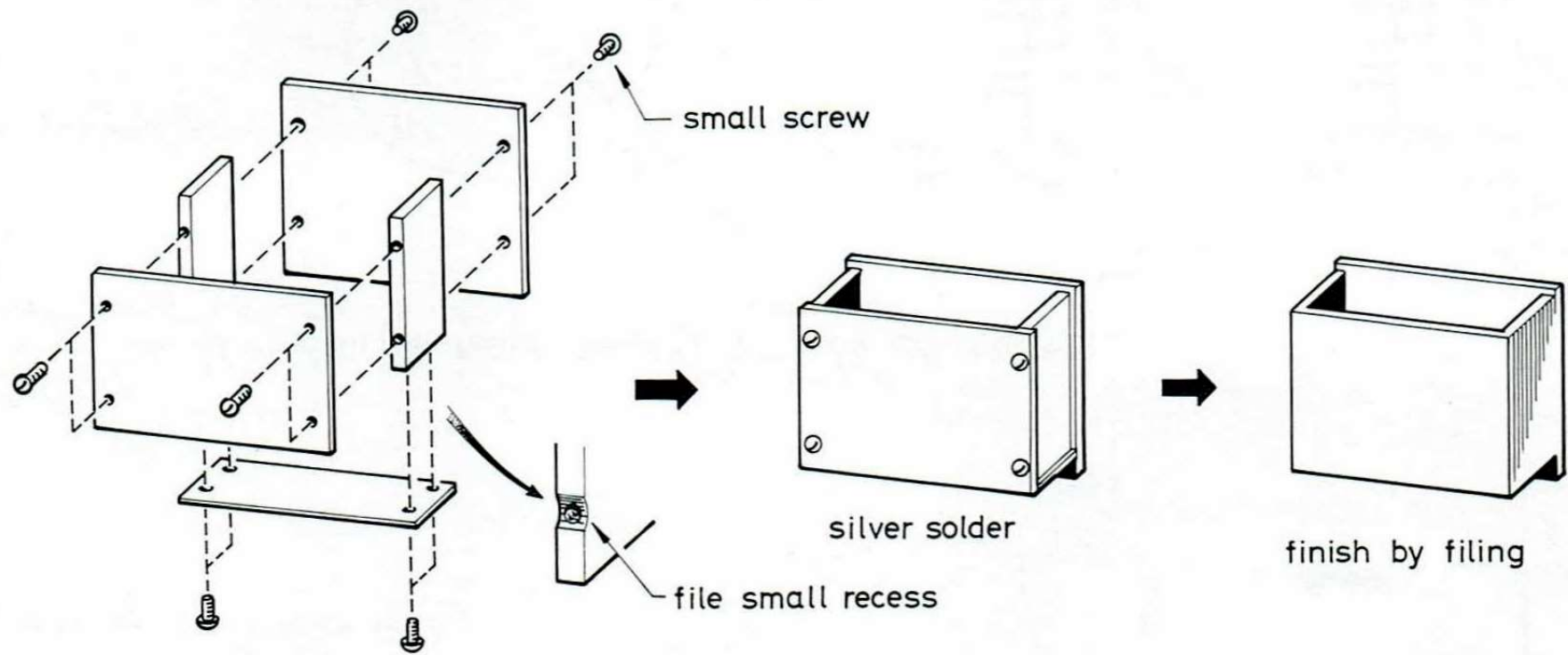


GOOD

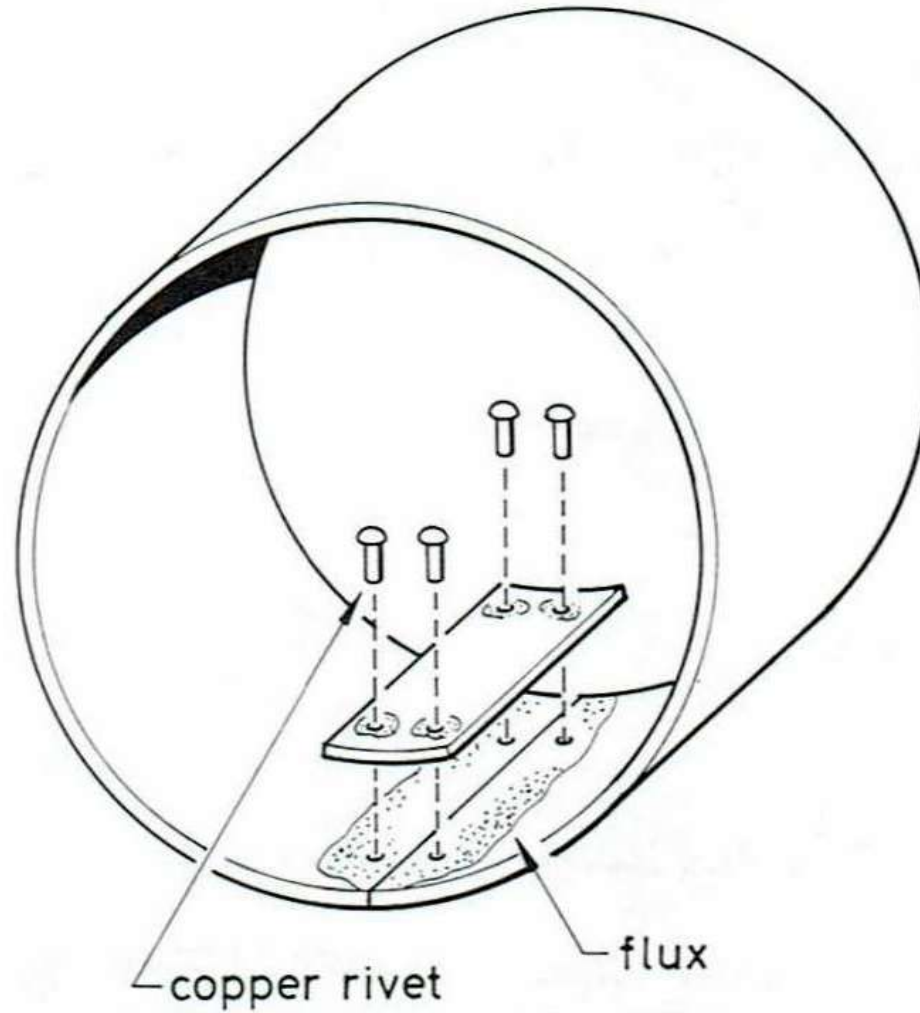


POOR

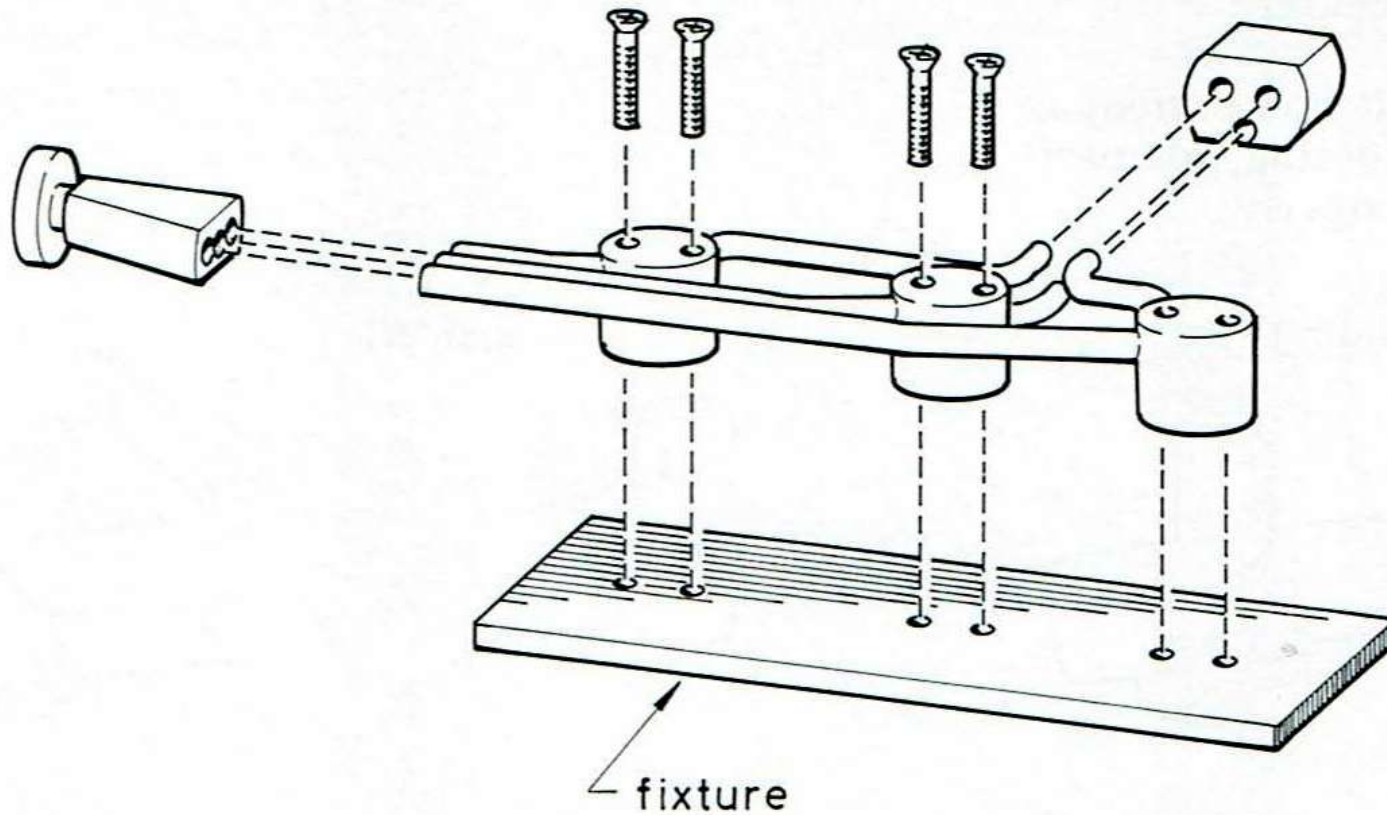
Assemble parts with screws



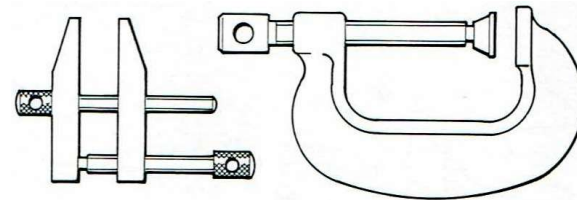
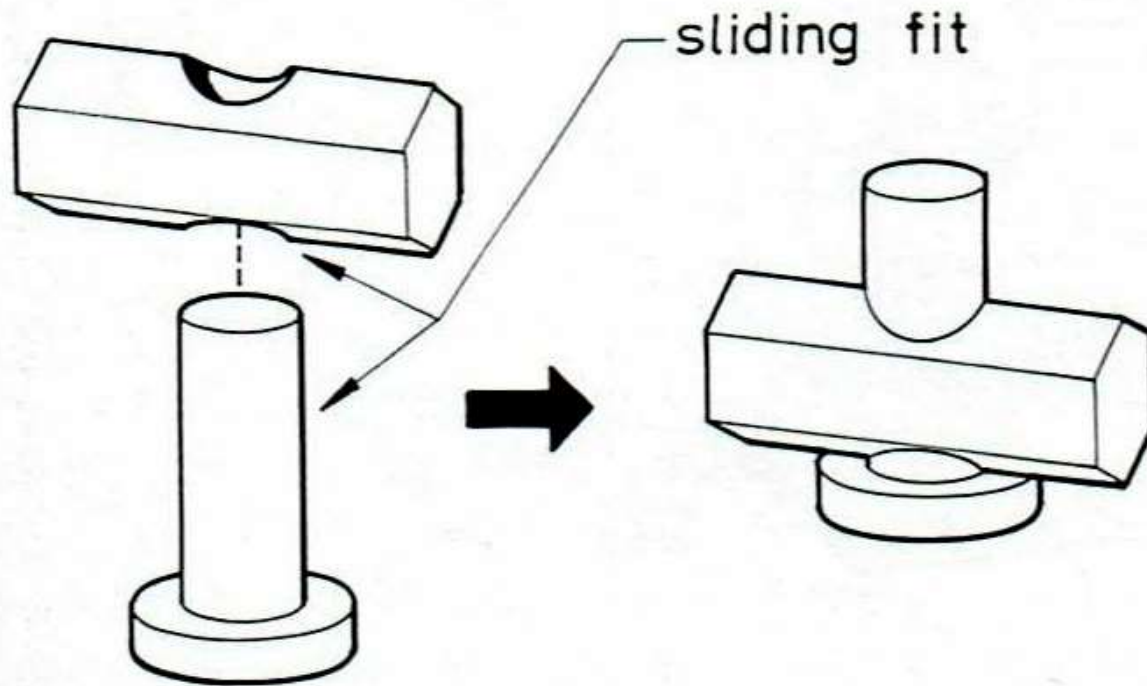
Assemble parts with rivets



Assemble parts with a jig

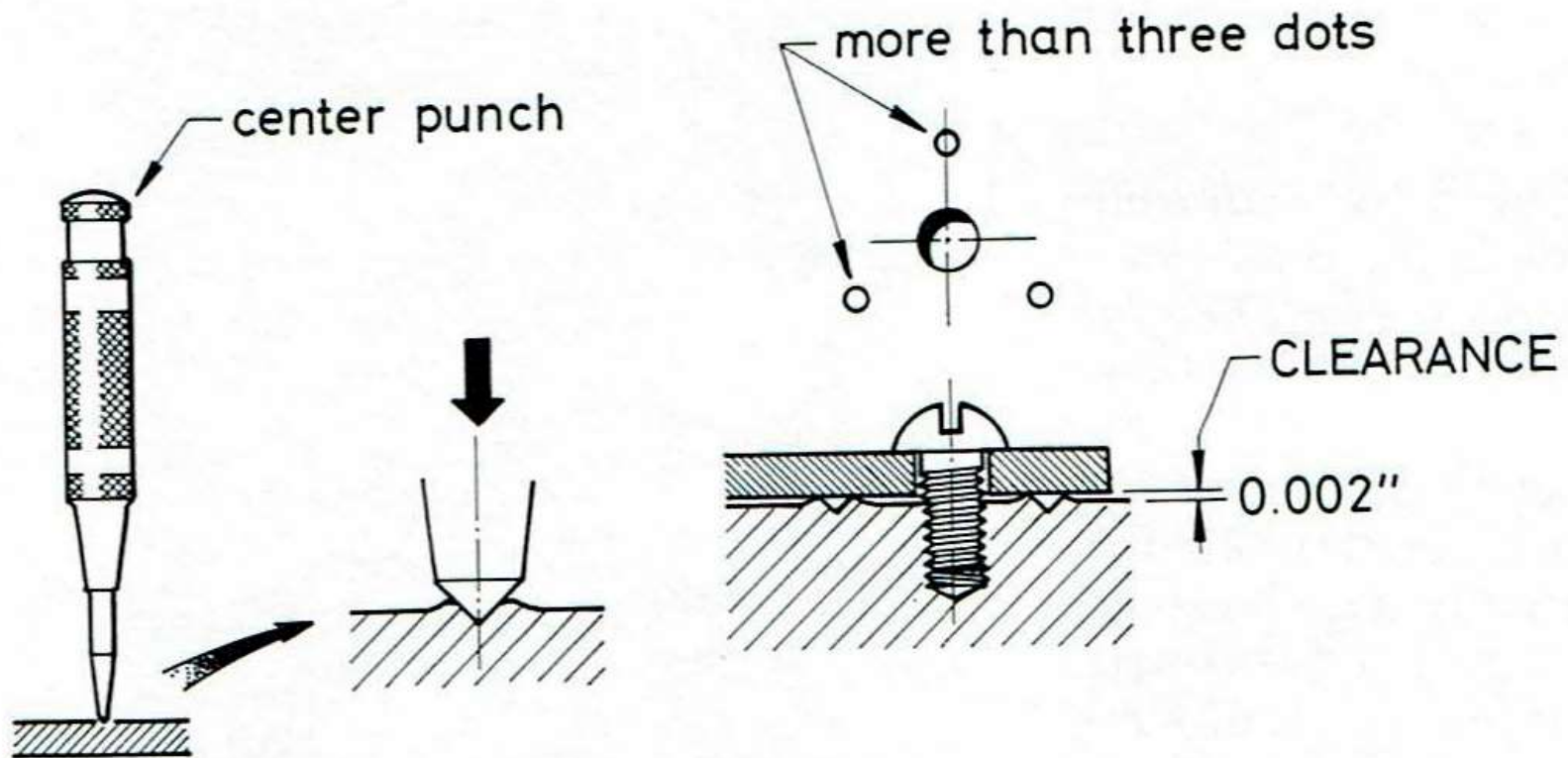


Assemble parts with gravity

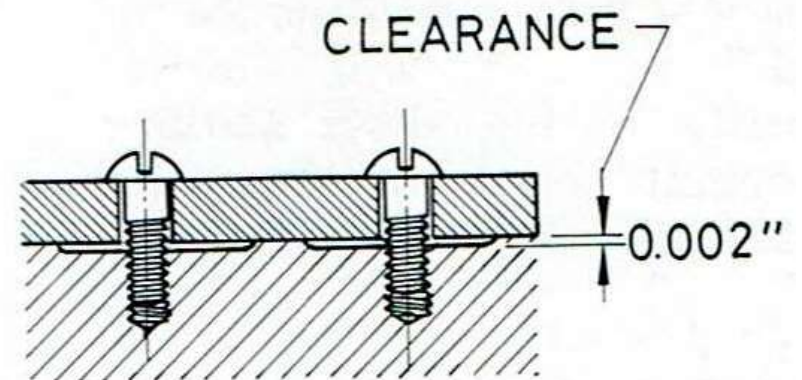
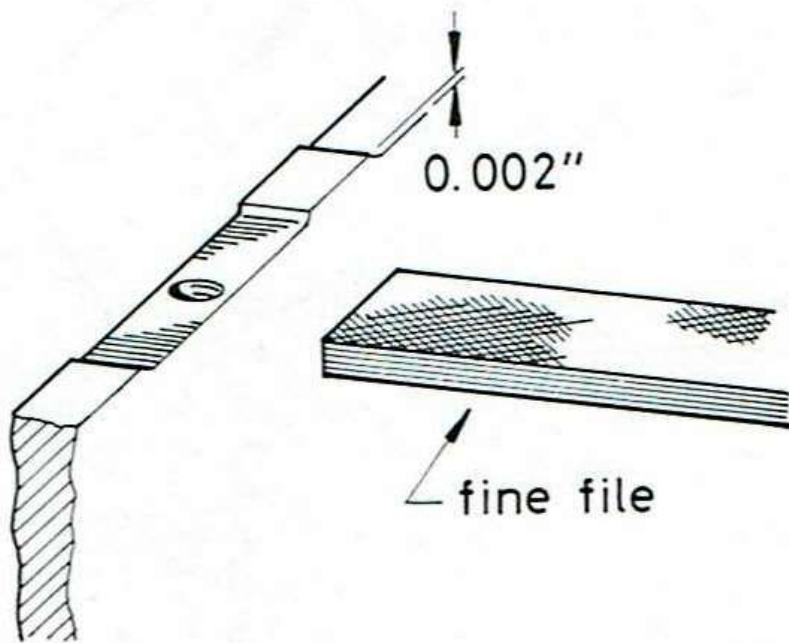


NO CLAMPS

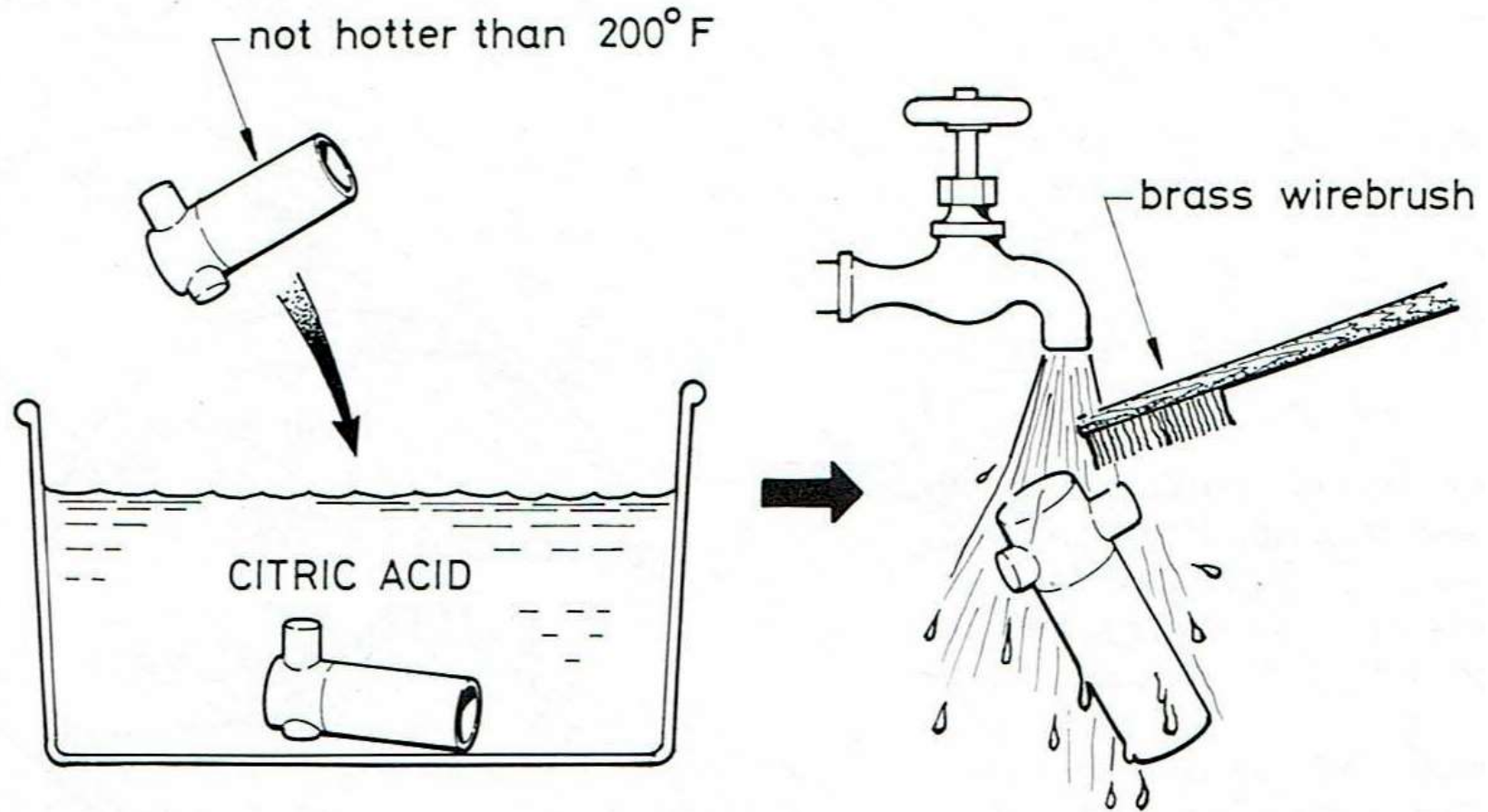
Clearance with punch marks



Clearance with filed recess

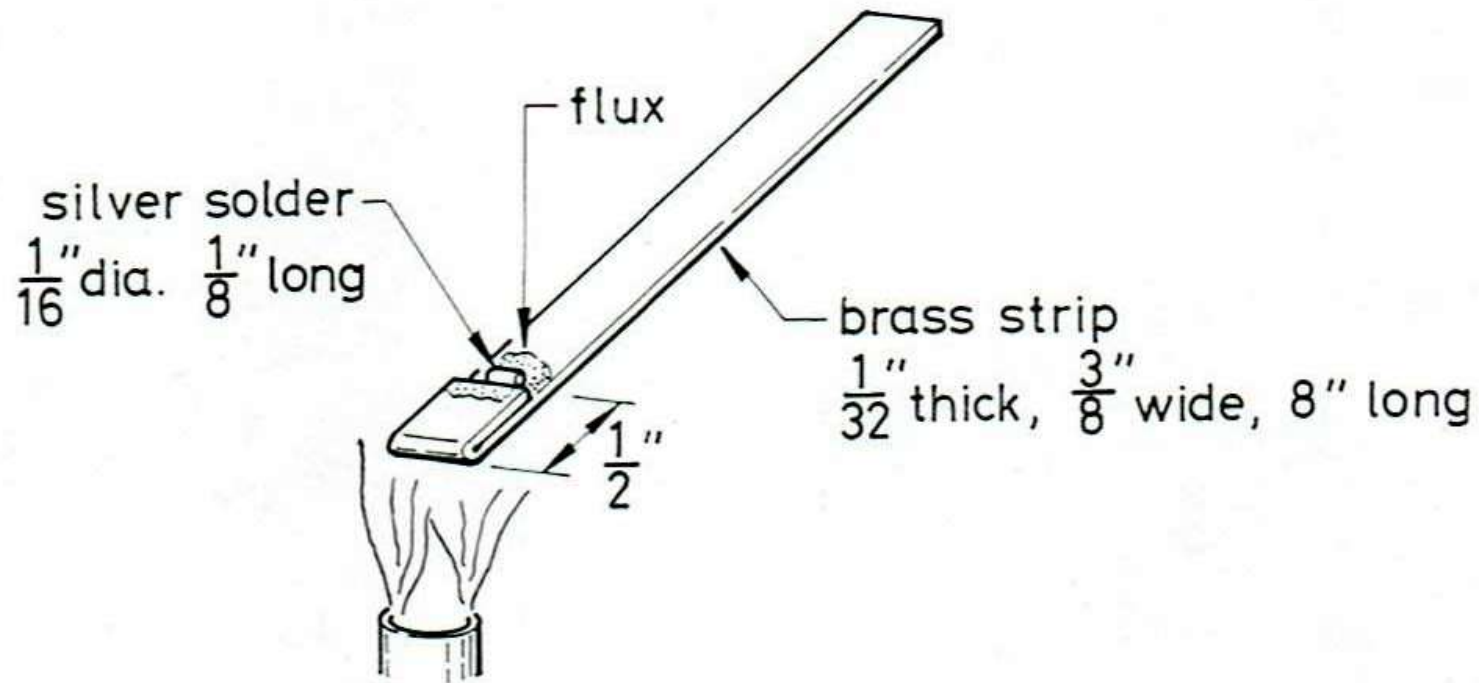


Remove flux residue



PICKLE FOR FINAL CLEANING

Homework assignment



A SAMPLE OF GOOD JOINT

Questions?